SESSILE-FLOWERED SPECIES IN THE *NAVARRETIA LEUCOCEPHALA* GROUP (POLEMONIACEAE)

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ABSTRACT

Navarretia myersii and *N. prostrata* of sect. *Navarretia* have a reduced habit, are nearly acaulescent, and have a terminal inflorescence. Mature floral heads bear sessile flowers and bracts on a common receptacle, surrounded by involucral leaves and bracts. This combination of features occurs also in a related, but new and rare plant described here as *N. myersii* subsp. *deminuta.* The three taxa are members of the *N. leucocephala* group, all of which are restricted to vernal pool habitats.

Members of the *Navarretia leucocephala* group of sect. *Navarretia* (Polemoniaceae) are all adapted to a vernal pool habitat. Included are *N. involucrata* Ruiz & Pavon of Argentina and Chile, which is the type species of the genus (Grant 1959), and four North American species, as recently treated (Day 1993a). These are *N. leucocephala* Benth. (with five subspecies), *N. fossalis* Moran, *N. prostrata* (A. Gray) E. Greene and *N. myersii* P. S. Allen & A. G. Day. The last two species differ from the others in having a reduced habit and involucrate inflorescence. A related, and newly discovered taxon is described below as *N. myersii* subsp. *deminuta.*

The first collection of *N. myersii* subsp. *deminuta* was brought to me as an unidentified *Navarretia* by Linda Huntington and Margaret Rockwood, who were making a botanical survey of property in southern Lake County, California (Huntington & Rockwood 1992). The plants were similar to *N. myersii,* a rare species that was described recently (Day 1993b).

Navarretia myersii P. S. Allen & A. Day subsp. *deminuta* A. G. Day, subsp. nov. (Fig. 1).—TYPE: USA, California, Lake County, 2 m. SE of Middletown, Long Valley, Butts Canyon Rd. at jct. with Callayomi Rd., 2 May 1994, *Day 94-1* (Holotype, CAS, Isotypes RSA, US).

Affinis subsp. *myersii* sed differt a foliubus brevibus (1–5 cm longibus); lobi bractearum multi et multipartiti cum dentibus attenuatibus: corolla azurea, tubus corollae brevis, calyce 1–1.2 plo longior.

Plants generally in dense colonies, acaulescent or nearly so, hypocotle thickened. Basal stem internodes 0–10 mm long. Leaves 2–

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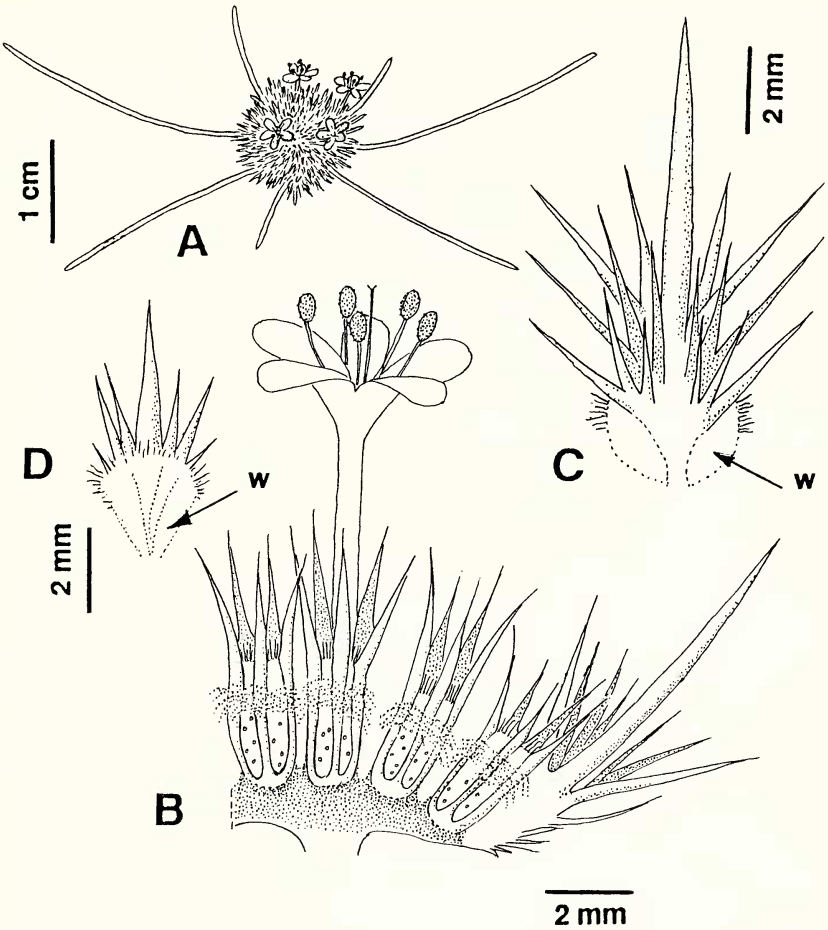

FIG. 1. *Navarretia myersii* subsp. *deminuta* A. G. Day, subsp. nov. A. Habit of plant, top view. B. Segment of inflorescence showing four flowers, one in bloom at an thesis. For clarity only one bract is shown (far right). Stippled area = receptacle. C–D. Bracts. w = membranous wing. C. Outer bract (dorsal view). D. Inner bract (ventral view). A. Drawn from *Huntington & Rockwood 10* (CAS). B–D. Drawn from fresh specimens (*Day 94-1* CAS). Drawings by author.

4 in opposite pairs, linear, entire, 1–5 cm long, radiating from beneath head, usually much exceeding it. Head 8–20 mm dia., terminal and involucrate with spreading, fleshy receptacle. Involucral bracts and flowers sessile on the common receptacle. Outer bracts 3–5, 1–2 cm long, winged and dorsally lobed at base; wing membranous, slightly villous, lobes numerous, attenuate, glabrous, spreading, forked or with 4–5 attenuate teeth. Inner bracts shorter, equaling or slightly

TABLE 1. COMPARISON OF THE INVOLUCRATE SPECIES OF *NAVARRETIA*.

	N. myersii subsp. *myersii*	*N. myersii* subsp. *deminuta*	*N. prostrata*
1. No. of secondary floral branches	0 (0–2)	0 (0–2)	Many (1–20)
2. Leaf form	Entire, or lobed only near base	Entire, or lobed only near base	Lobed from base to apex
3. Outer bract dissection	Lobes few, none above middle	Lobes many near base, few or none above	Lobed from base to apex
4. Bract wing	Densely villous	Slightly villous	Slightly villous
5. Calyx lobe length	< tube	= tube	< tube
6. Corolla length	17–21 mm	12–13 mm	6–9 mm
7. Corolla tube	2–4 × calyx	1–1.2 × calyx	<1–1 × calyx
8. Corolla color	White	Blue	White or blue
9. Pollen color	Yellow	White	White
10. No. of seeds per capsule	4–6	4–6	5–25

exceeding calyx. Calyx 5–6 mm long, villous about middle, lobes subequal tube, entire, attenuate, spreading. Corolla blue, 12–13 mm long, tube 7–8 mm long, exceeding longest calyx lobe by 1–2 mm. Stamens exserted, equaling corolla lobes. Pollen white. Style exserted to anther level, stigmas minute. Seeds 4–6 per capsule. Clay-loam soil of vernal pools and roadside depressions. A rare endemic, known only from type locality where it is abundant and well-established. Flowering April–May.

Paratypes: USA, California, Lake Co., Long Valley, at the type locality 2 m. E of Middletown, SW side Butts Cn. Road at intersection with Callayomi Rd., 21 May 1992, *Rockwood & Huntington* 10 (CAS); (same locality) 5 May 1993, *Rockwood & Huntington 41* (CAS); 14 May 1994, *Spencer 4514-H1* (RSA).

This new *Navarretia* is potentially endangered by its occurrence on a forty-acre parcel that is likely to be subdivided and sold, with probable disturbance of the vernal pool habitat.

The name *deminuta* refers to the small size of the plants, but other differences that distinguish it from subsp. *myersii* and *N. prostrata* are shown in Table 1. Compared with subsp. *myersii* it differs especially in the abundance of attenuate bract lobes at the base of the head, the blue (not white) corolla, and the much shorter corolla tube.

Observations and collections of *N. myersii* subsp. *deminuta* in three successive seasons, 1992–1994, showed how it responded to two relatively dry years and one wet year (spring 1993). The plants had the same basic morphology in the wet year as in the dry years, differing only in that the 1993 plants had longer leaves and generally broader heads with more numerous flowers.

Subspecies *deminuta* is isolated geographically from subsp. *myersii,* the latter occurring in a few rare localities bordering the Sierra Nevada foothills in California's Central Valley (Day 1993a, b) and from *N. prostrata,* which is mostly in Southern California, with a few sites in Monterey County and western central California.

Because subsp. *deminuta* appears somewhat different from subsp. *myersii* its status as possibly a distinct species was considered. However, there are intermediates between the two taxa. These include collections of *N. myersii* that were cited earlier as paratypes (Day 1993b). These specimens are less extreme than the type of subsp. *myersii,* and except for their white corollas they are very similar to subsp. *deminuta.* Thus, specimens from Amador Co. (*Heller 16114,* UC) and from Sacramento County (*Day & Allen 88-10,* CAS) have shorter corolla tubes than those from the type locality. Also, bracts of the Sacramento County plants usually have more lobes than those of the type material.

The cited intermediate collections from Amador and Sacramento counties are from considerably north of the type locality of *N. myersii* (E Merced County), but far southeast of the type locality of subsp. *deminuta,* and are thus geographically intermediate as well.

The inclusion of the Lake County race of *N. myersii* as a subspecies of *N. myersii* results in a range extension from the eastern side of the Central Valley to the Coast Ranges of southern Lake County, California.

Species Comparisons

In most Polemoniaceae branching is cymose (Grant 1959). This is true of *Navarretia,* but because the inflorescence is a head, the branches and pedicels are much reduced. Flowers of *N. leucocephala* and *N. fossalis* are short-pedicellate to sessile, but on closer examination they appear grouped in several clusters due to branching at a lower level within the head.

The modified inflorescence type of *N. myersii* and *N. prostrata* appears as a telescoped version of this pattern, and exhibits probably the greatest extreme of reduction in the *N. leucocephala* group. With basal stem internodes foreshortened, the leaves and outer bracts radiate outward in a whorl beneath the head (Fig. 1A). The mature inflorescence is terminal and unbranched, consisting of sessile flowers and associated sessile bracts on a common receptacle (Fig. 1B). Observed at a young stage the flowers arise in cymose sequence from the receptacle in the axils of bracts, but complete their development at one level (Fig. 1B).

The central head expands in diameter as new flowers arise in the axils of peripheral or inner bracts. As many as sixty flowers at various

stages of maturity were counted in a single head of *N. myersii* subsp. *myersii* (Day 1993b).

Secondary floral branches are rarely found in the subspecies of *N. myersii,* and are at most only one or two. A vigorous plant of *N. prostrata,* however, may have numerous secondary branches spreading from beneath the central head, as pictured by Mason (1951, p. 444).

Further comparisons of these two species (Table 1) shows that they differ also in leaf lobing (no. 3) and in the number of seeds per capsule (no. 10). In these two characters *N. prostrata* is more like *N. fossalis* than it is like *N. myersii.* However, differences between *N. prostrata* and *N. fossalis* are numerous, and are maintained in nature. The two species occur sympatrically on the Santa Rosa Plateau in Riverside County where they show no intergradation (Day 1993b). This was also verified recently by Spencer (personal communication, *Spencer 4601-11, 4601-12,* RSA).

Navarretia myersii and *N. prostrata* are placed together in the key below on the basis of their similar reduced habit and villous calyx tube. This may reflect relationship, due to a shared monophyletic origin, or, alternatively, the reduced inflorescence habit may have arisen more than once in different, but related species.

Key to the *Navarretia Leucocephala* Group, and to the Involucrate Species

1. Head cymosely branched within; flowers pedicellate to sessile; flowers and bracts borne separately; calyx tube generally not villous except in *N. fossalis* .... *N. leucocephala* and *N. fossalis*
1′. Head unbranched within, except secondary floral branches sometimes present: flowers and bracts sessile on a common receptacle; calyx tube villous.
   2. Corolla 6–9 mm long; calyx lobes often 3-fid; leaves strap-shaped, lobed from base to apex; secondary floral branches frequent (1–20) ..... *N. prostrata*
   2′. Corolla 12–21 mm long; calyx lobes entire, rarely 2- or 3-fid; leaves linear and entire, or lobed near base; secondary floral branches rare (0–2) .... *N. myersii*
      3. Corolla blue, tube 1–1.2× calyx; outer bracts at base of head many-lobed, bract wings slightly villous. ..... subsp. *deminuta*
      3′. Corolla white, tube 2–4× calyx; outer bracts at base of head few-lobed, bract wings densely villous ..... subsp. *myersii*

Acknowledgments

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Literature Cited

Day, A. G. 1993a. *Navarretia.* Pp. 844–849 *in* Hickman, J. (ed.), The Jepson manual, higher plants of California. University of California Press, Berkeley and Los Angeles, California.

———. 1993b. New taxa and nomenclatural changes in *Allophyllum, Gilia,* and *Navarretia* (Polemoniaceae). Novon 3(4):331–340.

Grant, V. 1959. Natural history of the *Phlox* family 1. Systematic botany. Martinus Nijhof, The Hague.

Huntington, L. and M. Rockwood. 1992. Botanical survey of Larson Subdivision, Butts Canyon Rd. Lake County Planning Department, Lakeport, California. 11 p. with map.

Mason, H. 1951. *Navarretia. In* L. Abrams, Illustrated flora of the Pacific States 3:440–452. Stanford University Press, Stanford, California.

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ANNOUNCEMENT

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